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(12) Patent:

(11) CA 311275

(54) METHOD OF BONDING DISSIMILAR METALS

(54) METHODE DE LIAISON DE METAUX DISSEMBLABLES

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ABSTRACT:

CLAIMS: [Show all claims](#)

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311275

May 12, 1931

S P E C I F I C A T I O N .

To all whom it may concern:

Be it known that I, JOHN V. O. PALM, of the City of Cleveland Heights, County of Cuyahoga, State of Ohio, United States of America, Engineer, having invented certain new and useful Improvements in "METHOD OF BONDING DISSIMILAR METALS", do hereby declare that the following is a full, clear and exact description of the same.

The present invention, relating, as indicated, to a method of bonding dissimilar metals, is particularly directed to a new and improved method of mechanically uniting dissimilar metals for use in composite bearings for various purposes, although numerous other uses for the present invention will readily suggest themselves to those skilled in the various arts. A further object of the invention is the provision of a new and inexpensive composite bearing of greater strength and longer life than those now in general use, and one which shall be adapted to substantially all bearing problems. To the accomplishment of the foregoing and related ends, said invention, then, consists of the means hereinafter fully described and particularly pointed out in the claims.

The annexed drawings and the following description set forth in detail one method and one product exemplifying my invention, such disclosed procedure and product constituting, however, but one of various applications of the principle of my invention.

In said annexed drawings:-

Fig. 1 is a transverse section illustrating apparatus which may be employed for performing the first step of my improved method; Fig. 2 is a similar view showing the second

step of the present method; Fig. 3 is a similar view illustrating the third step; Fig. 4 is a plan view of the product as constituted after the third step, this view also illustrating the method of blanking the strip; Fig. 5 is a plan view of a cut
 5 blank; Fig. 6 is a view showing the blank formed into a cylindrical bearing; Fig. 7 is a transverse section on an enlarged scale of the bond between the dissimilar metals prior to the forming of the completed blank into a curved bearing element; Fig. 8 is a similar view illustrating the bond between the metals
 10 after the formation of the completed strip into a curved element; Fig. 9 is a transverse section of the strip after the first operation; and Fig. 10 is a similar section after the second operation.

It has long been desirable to produce a bearing
 15 having a surface consisting of relatively soft bearing material, such as babbitt, with a rigid unyielding support therefor formed of a very much stronger metal, and numerous attempts have been made to produce such bearings either by casting softer metals against stronger, or by welding, brazing or otherwise securing
 20 the softer metal to the stronger through the application of heat. The ability of a metal to withstand pressure varies inversely as the thickness of the metal, and hence a thin layer of relatively soft metal will sustain pressure if supported by a layer of harder material better than a thick layer of such soft material. All
 25 of these methods, however, have two serious objections, one of which is the cost, while the second is the necessity for using relatively thick layers of the softer metal, and there is at present no method in use which permits of binding together two dissimilar metals having the character referred to without the
 30 application of heat. The present method provides for the manufacture of composite bearings of dissimilar metals, one of which

has the elements which are required in a supporting or backing-up metal, namely low cost and strength, while the other has the desirable characteristics of a good bearing metal, such as are possessed by babbitt or similar material. The present method consists, briefly stated, in first scarifying by knurling, indenting or some similar process, a relatively thin strip of an inexpensive but strong metal, such as cold rolled steel, then superimposing thereon a relatively thin strip of a bearing metal, such as babbitt or any other bearing metal which is capable of being rolled, and preferably hardened by such rolling, then subjecting the two superimposed sheets to transverse pressure, preferably by rolling, in order to roll the softer metal into the scarifications in the stronger metal and also to thin out and smooth and level the surface of the softer metal strip. Following these operations the strips are blanked or cut to the desired shape and are then formed to the desired shapes of bearings, and of course it will be evident that the prepared strips may either be used flat or as half round or completely cylindrical bearings, depending upon the use to which they are to be put.

Referring now to Fig. 1, in which the first step of my improved method is illustrated, there are shown two co-operative rolls 1 and 2, of which the roll 1 is provided with a plain cylindrical surface while the roll 2 is provided with projections 3. The two rolls are so related that a strip 4 of relatively strong metal, such as cold rolled steel, may be passed therebetween and will, during this operation, be scarified or knurled along one surface by the projections 3 of the roll 2, thus providing a series of indentations or recesses 5 in one surface of this strip of material. It will be evident that

apparatus other than that illustrated may be used for scarifying the surface of the strip 4.

In Fig. 2 I have shown other rolls 6 and 7, both of which have plain cylindrical surfaces, the peripheries of these rolls at their closest adjacent point being spaced a distance apart which is less than the thickness of the strip 4 after passage through the rolls 1 and 2. When the strip 4 is passed between rolls 6 and 7 the upper edges 8 of the originally formed recesses are rolled down to produce slightly overhanging edges 9, which are shown at the left in Fig. 2, in this way producing recesses which are smaller at the surface of the strip than at the interior, and which are thus self-locking against any other material which is forced into the recess. The first two operations, which have already been described, will efficiently work and thereby harden and temper or toughen the metal of the strip 4, and substantially any desired tempering or toughening can be produced in this strip by proper adjustment of the spacing between the rolls through which it is passed, the size and number of the projections 3 on the roll 2 and the spacing of the rolls 6 and 7 during the second operation.

I next superimpose upon the strip 4 a second strip of a relatively softer metal 10 which may be, as already explained, either babbitt or some similar bearing metal which has not only the desirable properties of a satisfactory bearing metal, but is also capable of being rolled. The strip 10 of bearing metal is relatively thin and is reduced somewhat in thickness by the passage of the multiple strip 4 and 10 through other cylindrical rolls 11 and 12, shown in Fig. 3. The passage of the composite strip through these rolls thins the strip 10 slightly and forces the metal of this strip into the

9

recesses 5 where this portion of the metal of the upper strip is locked in place by the overhanging edges 9 of the entrance to each recess or depression in the strip 4. During this operation the metal of the bearing strip 10 may or may not be hardened (depending on the metal) by the reduction in thickness to which it is subjected, that is, by the plastic flow of the metal, and this can of course be varied between wide limits, depending upon the characteristics desired in the finished bearing and upon the characteristics of whatever type of metal is used for the upper or softer strip.

In order to secure the required physical or mechanical bond between the upper and lower strips and give this bond a strength sufficient to prevent separation of the metals under severe types of service it is highly desirable to provide a sufficient recess area to approximate three or four times the normal surface area between the two strips. Where dissimilar metals are welded or brazed together, or where a softer metal is cast directly against the surface of a stronger metal, the area of bond between the surfaces of the two metals is never greater than the original area of contact before the bonding or welding operation. It will be evident that a mechanical bond is not as strong per unit of surface as a bond secured by brazing, welding or otherwise by the application of heat. It is essential that an increased area be provided in the present method, and I have found that if the total area of the recesses and of the surface which is not recessed aggregate three times or greater the original surface area of the strips in contact, the subsequent bearings are sufficiently bonded to prevent separation under all ordinary conditions of use.

The particular types of material which may be joined

by the present method will depend of course upon the uses to which the product is to be put, but I have found that in making composite bearings for use at various points in an automobile chassis a satisfactory product can be secured by the use of
5 a strip of cold rolled steel approximately $1/16$ of an inch or less in thickness, and by the use of a strip of babbitt or similar metal about .030 of an inch in thickness, which is then rolled down to a thickness of about .015 of an inch at the unrecessed portions, and a thickness of, say, .025 of an inch
10 through the portions extending into the recesses or pockets of the strips of stronger material. After the bonding of the two strips by the method already described the composite strips 15 may be cut into rectangular blanks 16, each of which may then be formed into suitable shape for a bearing. If these strips are then formed into cylinders, as shown in Fig. 6, or if they are curved or bent from their original flat condition there is of course a further working of the metal of both the supporting and the bearing strips and a slight narrowing of the mouth of each of the recesses, as illustrated by Figs. 7 and 8.

20 In Fig. 7 there is shown, on an enlarged scale, the condition of the two strips and their inter-relation after the operations already described, while in Fig. 8 I have shown a modification of this relation which occurs during the formation of the flat composite strip into a curved strip.

25 The present method offers an extremely rapid and very economical method for the production of composite bearings having the desired soft metal lining or bearing surface with a very much stronger supporting element behind the bearing metal itself. Under any rotation, unaccompanied by any impact loads
30 on the bearing, bearings made by the present method present all

of the advantages of the best types of babbitt bearings while, because of the extremely thin layer of babbitt and the close association between this layer of soft metal and the stronger layer of hard metal, the present bearing is also adapted for

5 all of the most severe impact loads.

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Fig 1

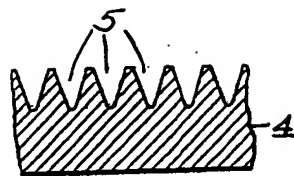
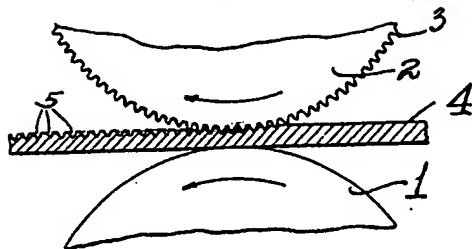


Fig. 9.

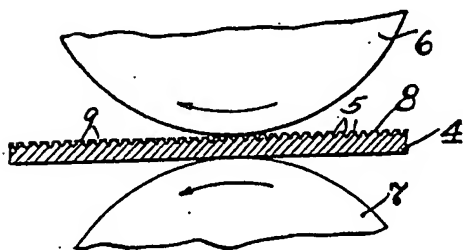


Fig. 2.



Fig 10

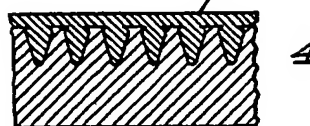


Fig. 7.

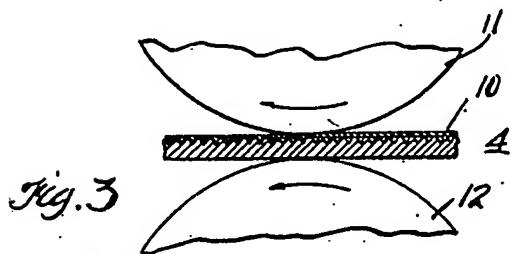


Fig. 3

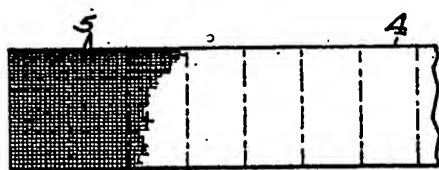


Fig 4

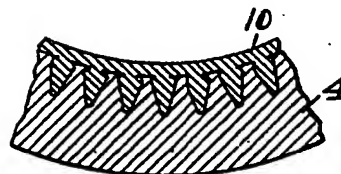


Fig. 8.

Fig. 5

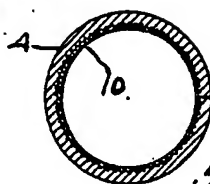


Fig. 6.

Certified to be the drawing
in the specification hereto annexed.

referred to

APPLICANT

John V. O. Palm

Cleveland O. U.S.A. April 13, 1926

Jay. Oberlin & Fay

ATTORNEYS

Other forms may be employed embodying the features of my invention instead of the one here explained, change being made in the form or construction, provided the elements stated by any of the following claims or the equivalent of such stated elements be employed, whether produced by my preferred method or by others embodying steps equivalent to those stated in the following claims.

I therefore particularly point out and distinctly claim as my invention:-

- 1 -

In a method of mechanically uniting dissimilar metals, the steps which consist in scarifying one surface of a metal sheet, superimposing a second sheet of a softer metal upon the scarified surface of said first-named sheet, and then subjecting said superimposed sheets to transverse pressure sufficiently to flow the metal of said softer sheet into the scarifications in the surface of said first-named sheet.

- 2 -

In a method of mechanically uniting dissimilar metals, the steps which consist in scarifying one surface of a metal sheet, superimposing a second sheet of a softer metal upon the scarified surface of said first-named sheet, and then subjecting said superimposed sheets to transverse pressure sufficient to thin the metal of said softer sheet and to flow the metal thereof into the scarifications in the surface of said first-named sheet.

-3-

In a method of uniting dissimilar metals, the steps which consist in scarifying one surface of a metal sheet, superimposing a second sheet of a softer metal upon the scarified surface of the first-named sheet, and then mechanically uniting said two sheets.

-4-

In a method of making a bimetallic bearing, the steps which consist in scarifying one surface of a sheet of relatively hard metal, superimposing a sheet of a bearing metal thereupon, then subjecting said superimposed sheets to transverse pressure to flow the softer metal into the scarifications in the harder metal, and then forming said sheets into a cylindrical bearing.

-5-

B In a method of making a bimetallic bearing, the steps which consist in scarifying one surface of a sheet of relatively hard metal, superimposing a sheet of bearing metal thereupon, then subjecting said superimposed sheets to transverse pressure to flow the softer metal into the scarifications in the harder metal, forming said sheets into a cylindrical bearing, and then burnishing the same after assembly in a housing.

-6-

A bearing comprising a sheet of relatively hard metal, and a sheet of relatively soft bearing metal mechanically united thereto.

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-7-

A bearing comprising a sheet of relatively hard metal, and a sheet of relatively soft bearing metal united thereto by a plurality of interlocking projections.

-8-

A bearing comprising a sheet of relatively hard metal, and a sheet of relatively soft bearing metal superimposed thereon, said first-named sheet having a plurality of recesses and said second sheet having a plurality of projections engaged in said recesses, and mechanically uniting said sheets.

Signed by me, at Cleveland, County of Cuyahoga,
State of Ohio, U. S. A., this 13th day of April, 1926.

John V. O. Palm

Witnesses:

Theo. S. Sadler

James L. Myers

B